CLAIMS

What is claimed is:

1. An apparatus comprising:

a boom means (11) for providing support;

a nuclear reactor means (19) for generating heat; said nuclear reactor means (19) being coupled to said boom means (11);

a payload protection means (20) for protecting a payload (15) from radiation; said payload protection means (20) being coupled to said nuclear reactor means (19);

a radiator means (16) for dissipating heat; said radiator means (16) being coupled to said nuclear reactor means (19);

an electric propulsion means (12) for supplying thrust; said electric propulsion means (12) being coupled to said nuclear reactor means (19);

a propellant tank means (13) for storing fuel for said electric propulsion means (12); said propellant tank means (13) being coupled to said boom means (11); and

a multiple-use grasping means (14) for engaging a satellite above the surface of the Earth; said grasping means (14) being coupled to said boom means (11), generally at one end of said boom means (11).

2. An apparatus as recited in Claim 1, in which said boom means (11) is a partially foldable frame which may be collapsed to fit within a launch vehicle.

3. An apparatus as recited in Claim 1, which may be launched into orbit using a single launch vehicle.

4. An apparatus as recited in Claim 1, in which said boom means (11) can be folded into a launch vehicle, and then be deployed in its fully extended position after launch.

5. An apparatus as recited in Claim 4, in which said launch vehicle is expendable.

6. An apparatus as recited in Claim 4, in which said launch vehicle is reusable.

7. An apparatus as recited in Claim 4, in which said reusable launch vehicle is a United States Space Shuttle.

8. An apparatus as recited in Claim 1, in which said boom means (11) also functions as a radiator means (16).

9. An apparatus as recited in Claim 1, in which said radiator means (16) also provides structural support and takes the place of said boom means (11).

10. An apparatus as recited in Claim 1, which is able to perform autonomous position and attitude control.

11. An apparatus as recited in Claim 1, in which said satellite is a satellite (15).

12. An apparatus as recited in Claim 1, further including a RADAR unit.

13. An apparatus as recited in Claim 1, further including a LIDAR unit.

14. An apparatus as recited in Claim 1, which is capable of rendezvous with a satellite (15) in orbit around the Earth.

15. An apparatus as recited in Claim 14, which is capable of navigation in orbit around the Earth

16. An apparatus as recited in Claim 1, which is capable of rendezvous with a satellite beyond Earth orbit.

17. An apparatus as recited in Claim 15, which is capable of navigation beyond Earth orbit.

18. An apparatus as recited in Claim 1, including an on-board sensor for performing a satellite rendezvous.

19. An apparatus as recited in Claim 1, including an on-board sensor for performing remote sensing.

20. An apparatus as recited in Claim 14, including an on-board sensor for performing remote sensing of a satellite in Earth orbit.

21. An apparatus as recited in Claim 17, including an on-board sensor for performing remote sensing of a satellite beyond Earth orbit.

22. An apparatus as recited in Claim 1, including an on-board camera for performing a satellite rendezvous.

23. An apparatus as recited in Claim 1, which is capable of docking with a satellite in orbit.

24. An apparatus as recited in Claim 1, which is capable of docking with a satellite beyond Earth orbit.

25. An apparatus as recited in Claim 1, including on-board sensor for performing a satellite docking maneuver.

26. An apparatus as recited in Claim 1, including an on-board camera for performing a satellite docking maneuver.

27. An apparatus as recited in Claim 1, in which said multiple-use grasping means (14) is not permanently affixed to a payload (15).

28. An apparatus as recited in Claim 1, in which said nuclear reactor means (19) includes an energy converter (22).

29. An apparatus as recited in Claim 28, in which said energy converter (22) is a direct energy converter.

30. An apparatus as recited in Claim 28, in which said energy converter (22) is an indirect energy converter.

31. An apparatus as recited in Claim 28, in which said energy converter (22) is a thermoelectric converter.

32. An apparatus as recited in Claim 28, in which said energy converter (22) is a Rankine Cycle converter.

33. An apparatus as recited in Claim 28, in which said energy converter (22) is a Stirling Cycle converter.

34. An apparatus as recited in Claim 1, in which said nuclear reactor means (19) is gas cooled.

35. An apparatus as recited in Claim 1, which said nuclear reactor means (19) is cooled by a liquid-metal.

36. An apparatus as recited in Claim 1, in which said radiation shield means (20) incorporates multiple zone shielding to minimize mass.

37. An apparatus as recited in Claim 1, further including a shield to provide protection from impact with a satellite (15) in space.

38. An apparatus as recited in Claim 1, in which said radiator means (16) is a pumped fluid loop.

39. An apparatus as recited in Claim 1, in which said electric propulsion (12) means is an ion propulsion system.

40. An apparatus as recited in Claim 39, in which said ion propulsion system (12) emits xenon ions.

41. An apparatus as recited in Claim 39, in which said ion propulsion system (12) includes a Hall thruster.

42. An apparatus as recited in Claim 1, in which said propellant tank means (13) may be refilled using a separate service vehicle.

43. An apparatus as recited in Claim 1, in which said propellant tank means (13) can be refilled in a relatively low gravity environment.

44. An apparatus as recited in Claim 1, in which said propellant tank means (13) may be filled with multiple propellants.

45. An apparatus as recited in Claim 1, which may be controlled from a terrestrial operations center.

46. An apparatus as recited in Claim 1, which is completely constructed on Earth.

47. An apparatus as recited in Claim 1, in which said multiple-use grasping means (14) may grasp a payload (15) after launch.

48. An apparatus as recited in Claim 1, in which said multiple-use grasping means (14) may release a payload (15) after launch.

49. An apparatus as recited in Claim 1, in which said multiple-use grasping means (14) is adapted to seize a satellite (15) in Earth orbit so it may be transported to a different orbit.

50. An apparatus as recited in Claim 1, in which said multiple-use grasping means (14) is adapted to seize a satellite (15) in Earth orbit to transport said satellite (15) to a different position.

51. An apparatus as recited in Claim 1, in which said grasping means (14) is adapted to engage a satellite (15) at a payload launch vehicle interface.

52. An apparatus as recited in Claim 1, in which said grasping means (14) is adapted to seize a satellite (15) in Earth orbit to transport said satellite (15) to another celestial body.

53. An apparatus as recited in Claim 1, in which said grasping means (14) is adapted to seize a satellite (15) in Earth orbit so it may be de-orbited.

54. An apparatus as recited in Claim 1, in which said grasping means (14) is adapted to seize a satellite (15) in Earth orbit so it may be transported for retrieval and repair.

55. An apparatus as recited in Claim 54, in which said satellite (15) is placed in an operational orbit by moving along an incremental, expanding, generally spiral pathway.

56. An apparatus as recited in Claim 1, which is positioned in orbit to provide a direct communication service.

57. An apparatus as recited in Claim 56, in which said direct communication service is conducted using frequency bands 11 and 12.

58. An apparatus as recited in Claim 56, in which said direct communication service is conducted in orbit around the Earth.

59. An apparatus as recited in Claim 56, in which said direct communication service is conducted beyond Earth orbit.

60. An apparatus as recited in Claim 56, in which said direct communication service is conducted using electromagnetic frequencies.

61. An apparatus as recited in Claim 56, in which said direct communication service is conducted using optical frequencies.

62. An apparatus as recited in Claim 56, in which said direct communication service is conducted at extremely high output power compared to conventional satellite operations.

63. An apparatus as recited in Claim 56, in which said direct communication service is conducted using a network.

64. An apparatus as recited in Claim 1, which is used to correct an anomalous satellite orbit.

65. An apparatus as recited in Claim 1, which is used to provide mobility for a satellite (15).

66. An apparatus as recited in Claim 65, in which said satellite (15) is moved from any orbit to any other orbit.

67. An apparatus as recited in Claim 65, in which said satellite (15) is moved from any position in any orbit to any other position in the same orbit.

68. An apparatus as recited in Claim 1, which is used to move a spare spacecraft (15) from a position in one orbit to a position in another orbit.

69. An apparatus as recited in Claim 1, which is used for inspection of a satellite (15) in orbit.

70. An apparatus as recited in Claim 1, which is used to repair a satellite (15) in orbit.

71. An apparatus as recited in Claim 1, which is used to extend the useful life of a satellite (15).

72. An apparatus as recited in Claim 71, which is used to extend the useful life of a satellite (15) by replenishing a consumable.

73. An apparatus as recited in Claim 71, which is used to extend the useful life of a satellite (15) by replenishing power.

74. An apparatus as recited in Claim 71, which is used to extend the useful life of a satellite (15) by replenishing fuel.

75. An apparatus as recited in Claim 71, which is used to extend the useful life of a satellite (15) by replacing a battery.

76. An apparatus as recited in Claim 71, which is used to extend the useful life of a satellite (15) by replacing a satellite component.

77. An apparatus as recited in Claim 65, which is used to reposition said satellite (15) from a lower to a higher orbit to realize cost savings compared to the costs of a conventional launch which brings a payload directly to a higher orbit.

78. An apparatus as recited in Claim 65, which is used to move said satellite (15) into a disposal orbit.

79. An apparatus as recited in Claim 65, which is used to provide services to an insurer.

80. An apparatus as recited in Claim 79, which is used to salvage a satellite (15) in accordance with an insurance contract.

81. An apparatus as recited in Claim 79, which is used to obtain information about a failure of an orbiting asset.

82. An apparatus as recited in Claim 79, which enables an insurer to lower an assessment of financial risks of a satellite launch.

83. An apparatus as recited in Claim 1, which is used to maintain a fleet of satellites (15).

84. An apparatus as recited in Claim 83, in which said fleet of satellites (15) includes the United States Global Positioning Satellites.

85. An apparatus as recited in Claim 71, which is used to supply on-orbit power to another satellite (15).

86. An apparatus as recited in Claim 85, which is used to supply on-orbit power to another satellite (15) using radiated microwave power transmission.

87. An apparatus as recited in Claim 85, which is used to supply on-orbit power to another satellite (15) by transferring of fuel cells.

88. An apparatus as recited in Claim 85, which is used to supply on-orbit power to another satellite (15) by a direct connection.

89. An apparatus as recited in Claim 1, which said nuclear reactor means (19) is cooled by a thermoelectric cooler.

90. An apparatus as recited in Claim 89, which is used to supply on-orbit power to another satellite (15) by a direct connection for recharging the power system of satellite (15).

91. An apparatus as recited in Claim 1, which is used to provide services to a spacecraft manufacturer.

92. An apparatus as recited in Claim 74, which is used to provide refueling services for another satellite (15).

93. An apparatus as recited in Claim 92, which is used to provide refueling services another satellite (15) by transferring fuel into a tank of satellite (15).

94. An apparatus as recited in Claim 92, which is used to provide refueling services another satellite (15) by transferring fuel into a tank containing fuel to satellite (15).

95. An apparatus as recited in Claim 1, which is used to provide services to a spacecraft user.

96. An apparatus as recited in Claim 1, which is used to provide services to a government agency.

97. An apparatus as recited in Claim 1, which is used as a reusable upper stage of a conventional launch vehicle to reduce launch costs.

98. An apparatus as recited in Claim 1, further comprising a recycling facility to recycle a satellite (15).

99. An apparatus as recited in Claim 1, further comprising an on-board laser.

100. An apparatus as recited in Claim 99, in which said on-board laser is used to divert a celestial body.

101. An apparatus comprising:

a collapsible boom (11); said boom being configured to collapse to fit within a launch vehicle and then expand once deployed in orbit;

a nuclear reactor (19) for generating heat; said nuclear reactor (19) being mounted at one end of said collapsible boom (11);

an energy converter (22) coupled to said nuclear reactor (19) for generating electrical power;

a payload protection shield (20); said payload protection shield (20) being disposed between a payload (15) and said nuclear reactor (19);

a radiator (16) for dissipating heat; said radiator (16) being connected to said energy converter (22);

an ion propulsion system (12); said ion propulsion system (12) being connected to said nuclear reactor (19);

a propellant tank (13) for storing fuel for said ion propulsion system (12); said propellant tank (13) being coupled to said collapsible boom (11); and

a multiple-use docking device (14) for engaging a satellite (15) above the surface of the Earth.

102. A method of building an orbital facility comprising the steps of:

providing a boom means (11) for providing support;

adding a nuclear reactor means (19) for generating heat; said nuclear reactor means (19) being coupled to said boom means (11);

adding a payload protection means (20) for protecting a payload (15) from radiation; said payload protection means (20) being coupled to said nuclear reactor means (19);

adding a radiator means (16) for dissipating heat; said radiator means (16) being coupled to said nuclear reactor means (19);

adding an ion propulsion system (12) for supplying thrust; said ion propulsion system (12) being coupled to said nuclear reactor means (19);

adding a propellant tank means (13) for storing propellant for said ion propulsion system (12); said propellant tank means (13) being coupled to said boom means (11); and

adding a multiple-use grasping means (14) for engaging a satellite (15) above the surface of the Earth; said grasping means (14) being coupled to said boom means (11).